

# A REVISION OF THE GENUS *BORRICHIA* ADANS. (COMPOSITAE)<sup>1</sup>

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## ABSTRACT

*Borrichia* Adans. (Compositae: Heliantheae) is a small North American genus of two well-collected species and their hybrid and one species known only from the type collection. *Borrichia frutescens* (L.) DC. grows in saline habitats along the Atlantic and Gulf coasts from Virginia to the Yucatán. *Borrichia arborescens* (L.) DC. occurs along the coasts of the northern West Indies and tropical Florida where it hybridizes with *B. frutescens*. The hybrids were first described as a species *B. × cubana* Britton & Blake (pro sp.). *Borrichia peruviana* DC. is known from the vegetative type collection. *Borrichia demissa* DC. has been excluded from the genus.

The only comprehensive treatment of the genus *Borrichia* DC. (Compositae, Tribe Heliantheae) the "Sea Ox-eye Daisy" was that of de Candolle (1836: 488–489). Since then several species have been described and the entire field of modern biosystematics developed. I have reviewed the chromosomal biology of the genus (Semple, 1978), and a detailed study of Floridian populations of *B. × cubana* Britton & Blake (pro sp.) has been made (Semple & Semple, 1978). The number of estimated species has been reported recently as seven by Willis (1966: 148) and Long & Lakela (1971: 833–834) and five by Gleason (1952: 339) and Correll & Johnston (1970: 1644–1645). This paper reviews the pertinent literature on the taxonomy of the genus and provides species descriptions and a key to the revised genus.

## NOMENCLATURAL HISTORY

Linnaeus (1753: 903) first described the type species as *Bupthalmum frutescens* L. from New World collections from Virginia and Jamaica and associated the species with the Old World taxon *Bupthalmum salicifolium* L. (designated type of *Bupthalmum*). Later, Linnaeus (1759: 1227) split *B. frutescens* into two species, with the Jamaican collection included in *B. arborescens* L. De Candolle (1836) recognized the significant differences between the Old World species, members of the Tribe Inuleae, and the New World species, and he placed the latter in *Borrichia*, a name proposed by Adanson (1763: 130) to honor the seventeenth century Danish botanist Ole Borch. Adanson did not list any species in his genus, however. De Candolle (1836) remedied this and in addition to the two Linnaean species which he transferred to *Borrichia*, *B. frutescens* and *B. arborescens*, he included three more species: *B. peruviana* DC., *B. argentea* DC. and *B. demissa* DC. De Candolle listed synonyms for the five

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species, as well. Of the three additional species only one, *B. peruviana*, is treated as distinct in this revision. The type collection is unfortunately vegetative only and little can be said about the taxon. The second species has been placed in synonymy under *B. arborescens* in this revision, while the third species *B. demissa* has been excluded from *Borrichia* based on fruit morphology.

Small (1903: 1262–1263) described another species, *B. glabrata* Small, from *Curtiss 1412* collected in tropical south Florida. In the 1915 edition of the *Flora of the Southeastern United States*, however, Small placed *B. glabrata* in synonymy under *B. arborescens*, having studied the species from locations other than the Florida keys.

The last species to be described was *B. cubana* Britton and Blake (Britton, 1920) based on a Cuban collection, *León 7244*. No further collections of this species were correctly identified except for those of Ekman from the same location several years later. My research has discovered ten more collections of this species made in the Florida Keys during the last 75 years by several botanists, including Small. Several extensive populations of the taxon were also located during June of 1975.

The status of each taxon was investigated through field work, chemical and cytological studies, experimental greenhouse studies when possible, and examination of herbarium specimens from the following herbaria: BUS, F, FAU, FLAS, FSU, GH, IJ, MO, MSC, SMU, TEX, TUFTS, US, USF, and WAT. The curators of these institutions are thanked for their cooperation.

#### SYSTEMATIC TREATMENT

***Borrichia*** Adans., *Fam. Pl.* 2: 130. 1763. Based on Dillenius *Etham. tab.* 83, *fig.* 43 = *B. arborescens*; *fig.* 44 = *B. frutescens*.

*Diomedea* Cass., *Bull. Sci. Soc. Philom. Paris* 1817: 70. 1817. TYPE: *D. bidentata* Cass. = *Borrichia frutescens* (L.) DC.

Soboliferous or fruticose *perennials* to 1.5 m tall; roots fibrous, at times adventitious; stems woody, decumbent to erect, branching, the sap sticky resinous. *Leaves* opposite, heteroblastic; primary stem leaves petioled to nearly sessile, occasionally serrate-dentate; secondary branch leaves progressively more linear-oblongate, entire and reduced in size, 2–10 cm (rarely more) long, glabrous to pubescent, firm, coriaceous or succulent, mucronate, the teeth often spinulose. *Inflorescence* terminal solitary heads or a few heads clustered on short lateral branches. *Heads* globose to turbinate; phyllaries in 2–3 series, the outer ones larger and decussate, ovate with a spinulose tip or merely acute-cuspidate, 10–45; receptacle slightly convex, the paleas partially enclosing fruit, resembling the inner involucre bracts; ray florets pistillate, yellow, the strap ovate, the apex notched; disc florets perfect, yellow, tubular, the anthers black with orange connective glands, the style bifurcate, terete, the style branches papillate. *Fruits* (cypselas) of the periphery laterally compressed, appearing 3-angled, transversely depressed obtrullate in cross-section, those of the center 4-angled, tapering at base, rhombic in cross-section, gray to black, glabrous, faintly finely reticulate; pappus a 3–4-angled united crown, straw colored, occasionally deciduous on older fruits after release from head. Chromosome number:  $x = 14$ ,  $n = 14$ .



Lectotype species: *Borrichia frutescens* (L.) DC.

As delimited in this revision, *Borrichia* includes shrubs with opposite leaves and yellow-flowered, essentially solitary, radiate heads. The diagnostic character is the achene pappus, which is straw colored and forms a 3–4-angled united crown on the black 3–4-angled achene. The leaves of the plant are used as a medicinal tea in the Bahamas (Eldridge, 1975).

KEY TO THE TAXA OF *BORRICHIA* IN NORTH AMERICA AND THE WEST INDIES

- a. Involucral bracts obtuse to acute, not spinulose tipped; leaves of mature plants entire, glabrous or sericeous; chaff paleas papery, the apex obtuse or acute ..... 2. *B. arborescens*
- aa. Involucral bracts prominently spine tipped; leaves of primary branches serrate or dentate, villous-sericeous (rarely coriaceous and glabrous).
  - b. Involucral bracts long spinulose tipped, often strongly reflexed; primary and secondary branch leaves mostly with large petiolar spines; chaff paleas folded, spinulose tipped ..... 1. *B. frutescens*
  - bb. Involucral bracts cuspidate, not reflexed nor swollen in fruiting heads; primary and secondary branch leaves serrate or dentate along the mid portion of the blade only, often undulate and coriaceous; chaff paleas cuspidate tipped ..... 3. *B. × cubana*

NOT INCLUDED IN KEY: 4. *B. peruviana*, known only from the vegetative type collection. See text.

1. *Borrichia frutescens* (L.) DC., Prodr. 5: 488. 1836.

*Buphthalmum frutescens* L., Sp. Pl. 903. 1753. TYPE: Virginia (?BM, not seen).

*B. incanum* Mill., Gard. Dict., ed. 8. 1768. TYPE: Bahamas (not seen).

*Diomedea bidentata* Cass., Dict. Sci. Nat. 13: 283. 1819. Based on *Buphthalmum frutescens* L.

*Borrichia frutescens* (L.). DC. var. *angustifolia* DC., Prodr. 5: 489. 1836. TYPE: Mexico, Tampico, *Berlandier* 126 (G, seen on microfiche).

*Soboliferous perennials*, forming dense clones, overwintering by rhizomes, *fruticose perennials* in areas without killing frosts. *Leaves* heteroblastic villous-sericeous; primary branch leaves petiolate, obovate to elliptic, the apex acute or mucronate, the margins basally serrate-dentate spinulose (rarely along most of margin), the blade attenuate, the petiole with one or more pairs of large spinulose teeth near the base; secondary branch leaves becoming progressively more sessile, entire, oblanceolate-linear, the apex acute or mucronate. *Heads* solitary, terminal and on lateral branches near the shoot apex, globose; peduncles 2–6 cm long; phyllaries in 3–4 unequal series, 20–40, the outer shorter, 2–4 mm long, the apex obovate with a woody recurved spine, the inner similar with the spines spreading to erect, 3–6 mm, sericeous except for the spines; receptacle slightly convex, the chaff folded, oblanceolate, 4–6 mm long, with a long orange yellow, woody spine 1.5–3 mm long, becoming thickened with age; ray florets pistillate, fertile, yellow, 15–30; disc florets perfect, fertile, yellow, 20–75. *Fruits* (cypselas) black at maturity, 3–4 angled, the peripheral ones transversely depressed obtrullate in cross-section, the inner rhombic in cross-section, 2.5–4(–5) mm long; pappus a 4-angled united crown, straw colored. Heads disintegrating after one or more seasons, globose, the outer phyllaries fully reflexed due to the thickening of the phyllaries, chaff, and fruit. Chromosome number:  $n = 14$  (rarely  $3x$ ).



## DISTRIBUTION AND HABITAT

*Borrichia frutescens* is a common member of the salt marsh community and brackish backwaters along the Gulf and Atlantic coasts from Virginia to the west coast of the Yucatán Peninsula in Mexico. The species occurs inland along the Rio Grande Valley in Texas and as far as the State of Coahuila in northern Mexico. It is present along the coasts of the Bermuda Islands, but normally is absent from the West Indies. The species was collected once on Grand Bahama Island, *Allen 29* (GH), annotated by Britton & Millspaugh as *B. aborescens* (probably because the plant is neotonous), and was collected near Havana, Cuba, *Ekman 13,292* (F, CH, NY, US). The duplicates range from typical *B. frutescens* to more *B. cubana*-like and may represent part of a hybrid swarm. These collections by Eckman were originally identified as *B. cubana* and are from the type location of that taxon. Both the Cuban and Bahamian collections are probably only chance introductions. Figure 1 (dots) illustrates the distribution of the species based on herbarium collections.

## MORPHOLOGICAL VARIATION

The species varies greatly in size of the heads and the degree of leaf serration-dentation. Field observations indicate that the variation in head size is in part due to environmental factors. The time of year when the head is produced and the general vigor of the plant affect head size. Various degrees of leaf serration-dentation occur throughout the range, although extreme forms are more common in southern Texas. Typically the blade margins are serrate along the basal third to half, while some specimens have some leaves with most of the blade serrate: Flamingo, Florida, *Godfrey et al. 63379* (FSU); Nuevo Laredo, Nuevo León, Mexico, *Frey & Frey 2337* (GH). While isolated individuals may appear to warrant taxonomic status, such extremes merely represent the ends of continuous variation of several characters in a single phenotype.

On some specimens the outer two involucre bracts may be large (1–2 cm) and appear more leaflike due to the lack of the long woody spine. The extreme forms of this variation are again merely the end of a continuum and do not warrant taxonomic recognition.

Field studies revealed that some plants may rarely produce leaves that are glabrate in part or entirely. This may represent some environmentally induced return to the seedling leaf form. Experimentally grown plants were found to produce several pairs of juvenile leaves that were glabrate and without serrate-dentate margins before producing more typical leaves. In this condition the seedlings may be confused with *B. arborescens*, although the involucre bracts that are produced by such unusually early flowering plants are typical. Figure 2 illustrates the branching pattern, leaves, involucre and phyllaries, and a disc fruit of *B. frutescens*.

BERMUDA. Castle Harbor, Admiral's Cove, *Brown & Britton 968* (NY). Long Bird Is., *Marble 762* (NY). St. David's Is., Red Bay, *Brown & Britton 1063* (NY). Walsingham, *Brown & Britton 281* (F, GH, NY, US); *Collins 305* (F, NY, US); *Rankin s.n.* (NY); *Marsh 1636* (F, GH, SMU, TEX).

MEXICO. CAMPECHE: S of Lerma, *Sauer 2429* (F). YUCATÁN: Progreso, *Gaumer 1161*



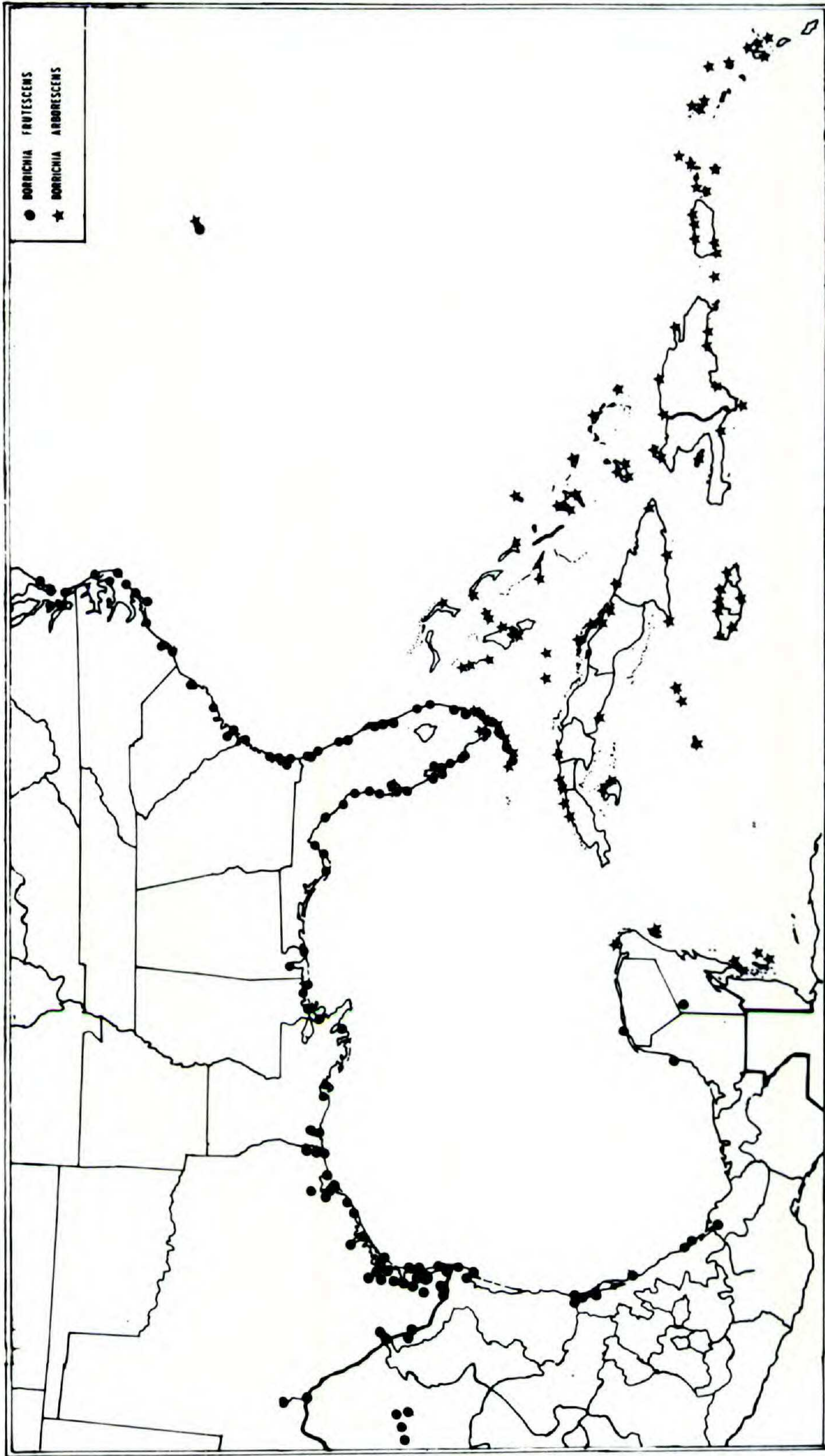


FIGURE 1. The distribution of *Borrichia frutescens* (dots) and *B. arborescens* (stars) based on herbarium collections. *Borrichia* × *cubana* (not shown) occurs in the Florida keys and was collected in 1917 and 1921 at the type locality west of Havana, Cuba.



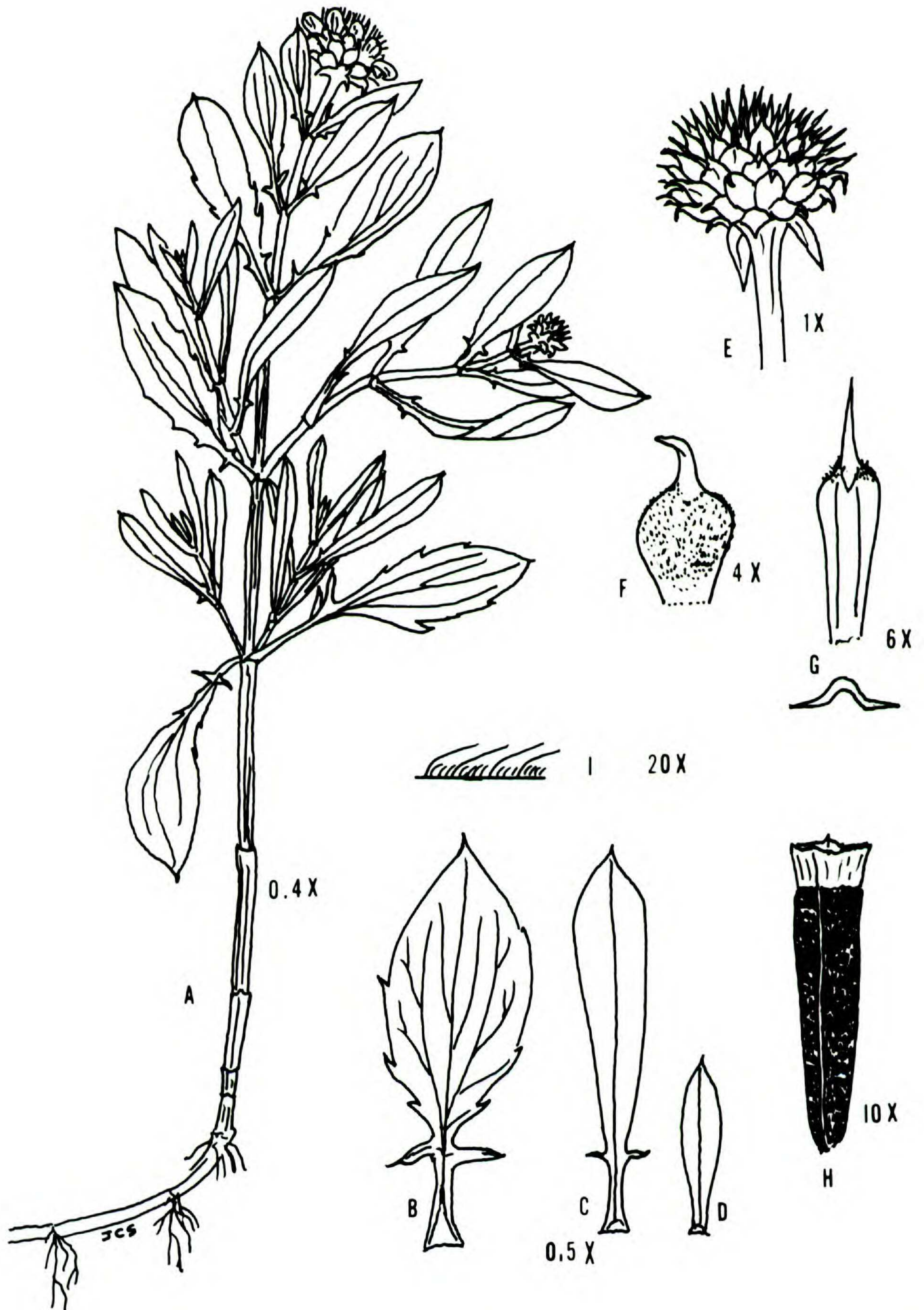


FIGURE 2. *Borrighia frutescens* (L.) DC.—A. Shoot from rhizome.—B–D. Primary stem leaf, branch leaf, higher level branch leaf, respectively (pubescence not indicated; all at same scale).—E. Fruiting head.—F. Phyllary of middle series.—G. Receptacle chaff.—H. Mature fruit of central disc floret.—I. Leaf surface pubescence diagram. (Based on many collections.)



(F, MO, US); *Lundell* 7951 (F, GH, NY, TEX, US). COAHUILA: W of Hermanas, *Turner* 6350 (TEX). Cuatro Ciénegas, *Marsh* 2033 (F, GH, TEX). QUINTANA ROO: Lake Chichankanab, *Gaumer* 2209 (F, GH, MO, US). SAN LUIS POTOSÍ: Hacienda de Angosturo, *Pringle* 3757 (F, GH, MO, US). TAMAULIPAS: S of Matamoros, *Wooten* 29 (US). Tampico, *Palmer* 100 (F, GH, MO, NY, US). VERACRUZ: Barra de Tuxpan, *Sauer & Gade* 2985 (F). 4 km S of state line, *Newling & Gómez-Pompa* 388 (GH). 8 km before Tampico, *Chiang* 73 (F, GH).

UNITED STATES. ALABAMA: Mobile, Dauphine Is., *Mohr s.n.* (US). FLORIDA: Brevard Co., Titusville, *Nash* 2289 (F, GH, MO, NY, US). Broward Co., Hollywood, *Demaree* 18714 (FLAS). Collier Co., Marco, *Hitchcock s.n.* (F); *Standley* 12793 (US). Citrus Co., Pirates Cove, *Genelle & Fleming* 1272 (USF). Dade Co., Coconut Grove, *Young* 50 (US). Elliot's Key, *Small & Nash s.n.* (NY). Homestead, *Godfrey* 58125 (USF). Miami, *Garber s.n.* (GH, NY); *Small* 5456 (GH, NY, US); *Small & Carter* 1214 (F, NY). Duval Co., Shell Is., *Curtiss* 1413 (F, MO, US). Franklin, NE of Alligator Pt., *Kral* 2798 (FLAS, GH, NY, USF). Hernando Co., Pine Is. causeway, *Kral* 7015 (FLAS, GH, USF). Hillsborough Co., Mullet Key, *Long* 1264 (USF). NW Tampa, *Lakela* 25012 (GH). Indian River Co., Vera Beach, *Demaree* 41973 (SMU). Lee Co., Punta Rassa, *Hitchcock* 136 (F, GH, MO, NY, US). *Standley* 265 (F, GH, MO, US). Monroe Co., Big Pine Key, *Killip* 41804 (F, US); *Traverse* 715 (GH, SMU, TEX). Flamingo, *Traverse* 624 (SMU, TEX). Pasco Co., Port Richey Bay, *Lakela & Patman* 9983 (FLAS, GH, USF). Wakulla Co., Panacea Shores, *Henderson* 63-1241 (TEX). GEORGIA: Glynn Co., Brunswick, *Small s.n.* (F, NY). St. Simon's Is., *Cronquist* 5351 (GH, MO, NY, SMU). McIntoch Co., Sapelo Is., *Duncan* 20162 (GH, SMU, TEX, UC). LOUISIANA: Cameron Pa., Cameron, *Tracy* 8664 (F, GH, MO, NY, US). MISSISSIPPI: Harrison Co., Biloxi, Ship Is., *Demaree* 31909 (F, TEX), 35023 (USF). Jackson Co., Horn Is. Wildlife Refuge, *Valentine s.n.* (FLAS, SMU). NORTH CAROLINA: Carteret Co., Beaufort, *Godfrey* 6492 (US); *leClair* 5863 (NY); *Channell & Rock s.n.* (GH). Hyde Co., Ocracoke Is., *Kearney* 2285 (US). SOUTH CAROLINA: Charleston Co., McClellanville, *Godfrey & Tryon* 251 (F, GH, MO, NY, US). Horry Co., Lillte R. Bindge, *Bell* 7711 (USF). TEXAS: Calhoun Co., Port. Alto, *Drushel s.n.* (MO). Cameron Co., Boca Chica, *Webster & Wilbur* 3042 (SMU). Galveston Co., E of Alvin, *n = 14<sub>II</sub> Raven & Gregory* 19413 (TEX). Karnes Co., S of Kenedy, *Johnson* 960 (SMU). Kenedy Co., El Toro Is., *Tharp* 49128 (US). Nueces Co., Corpus Christi, *Heller* 1786 (GH, MO, NY, SMU, US). San Patricio Co., Aransas Pass, *Schulz* 834 (US). Sinton, *Wolcott & Barkley* 16-413 (GH, NY, TEX). Webb Co., E of Laredo, *Gutierrez* 88 (SMU, TEX). Banks of the Pecos, *Wright* 1407 (GH, MO, NY, US). VIRGINIA: Accomac Co., Chincoteague Is., *Eiten* 936 (NY). Anne Northhampton Co., Capeville, *Hunnewell* 17007 (GH). Princess Anne Co., Lynnhaven Inlet, *Randolph* 429 (GH).

WEST INDIES. BAHAMAS: Grand Bahama Is., *Allen* 29 (GH).

## 2. *Borrichia arborescens* (L.) DC., Prodr. 5: 489. 1836.

*Buphthalmum arborescens* L., Syst. Nat., ed. 10. 1227. 1759. Based on Plumier, Pl. Amer. tab. 106, fig. 2. 1756.

*Diomedea indentata* Cass., Bull. Sci. Soc. Philom. Paris. 1817: 70. 1817.

*D. glabrata* H.B.K., Nov. Gen. Sp. Pl. 4: 213. 1820. TYPE: Cuba (not seen). Cites *Buphthalmum arborescens* L.

*D. argentea* H.B.K., Nov. Gen. Sp. Pl. 4: 213. 1820. TYPE: Cuba (not seen). Cites *Buphthalmum Peruvianum* Lam. and *B. lineare* Willd. Sensus D.C. pro parte ex syn. *B. peruviana* and *B. lineare*.

*Buphthalmum canum* L'Her. ex Dun. in DC., Prodr. 5: 489. 1836, pro syn.

*B. argentea* (H.B.K.) DC., Prodr. 5: 489. 1836.

*Borrichia glabrata* Small, Fl. S.E. U.S. 1263. 1903. TYPE: Florida, *Curtiss* 1412 (NY, holotype; F, GH, MO, NY, isotypes).

*Fruticose perennials* to 1.5 m tall, decumbent to ascending, forming clones by rooting or drooping stems and by rhizomes. *Leaves* succulent, opposite, oblanceolate-oblinear, very shortly petioled, the blade attenuate; juvenile leaves of seedlings glabrous, apically serrate; adult leaves entire, mucronate, 5–10(–15) cm long, becoming reduced in size on higher order branches. *Heads* solitary, ovate; peduncles 0.5–5 cm long; phyllaries 10–16, the outer in pairs, succulent, ovate-elliptic, obtuse or acute, glabrate or sericeous, 6–9 mm long, the inner



oblanceolate acute to rounded, glabrous, 6–9 mm long; receptacle slightly convex, the chaff similar to the inner phyllaries, oblanceolate-linear, acute to rounded apically; ray florets pistillate, fertile, yellow, 7–15; disc florets perfect, fertile, yellow, 20–50. *Fruits* (cypsela) black at maturity, 4-angled, transversely depressed obtrullate to rhombic in cross-section, 3.5–5 mm long, pappus a 4-angled united crown, straw colored; heads hemispheric at maturity, dark brown with the apices of the phyllaries and chaff often disintegrating, whole heads disintegrating after one or more seasons. Chromosome number:  $n = 14_{II}$  (possibly aneuploid with  $2n = 26-30$ ).

#### DISTRIBUTION AND HABITAT

*Borrichia arborescens* is common along the rocky coasts and sandy marshes and beaches of the Florida Keys, Bermuda, the West Indies from Jamaica and Guadeloupe northward, and the barrier islands of Belize and the east coast of the Yucatán Peninsula. The species's northern extension in the United States is Miami, Florida. Figure 1 (stars) shows the distribution of *Borrichia arborescens* based on herbarium collections. In frequently collected areas some symbols have been left out for clarity.

#### MORPHOLOGICAL VARIATION

Two forms typically occur throughout the range: sericeous individuals with obovate-oblanceolate to oblanceolate leaves and glabrate individuals with similar or more linear leaves. The shape of the leaf varies considerably, even on the same plant in some cases. In the Florida Keys the glabrous form is the only one present, while elsewhere both forms may occur. Field work in the Bahamas indicates that the pubescent form may be an ecotype more adapted to the rocky limestone coasts, while the glabrous form is more common in the mangrove swamp areas and brackish lagoons. This is not absolute though and both forms may occur in most habitats.

Small (1903) segregated the extremely large glabrate-leaved individuals as *B. glabrata*, but later reconsidered and treated the form merely as a variety. In the Bahamas many plants were found to possess both glabrate and pubescent leaves. *Borrichia argentea* was the name applied to the other end of the continuum; plants with small, obovate, pubescent leaves. Near George Town, Great Exuma, Bahamas, individuals were found with leaves of the *glabrata*-type and leaves of the *argentea*-type. The existence of such populations indicates the existence of a single variable species. I (Semple, 1970) found the same situation for *Conocarpus erectus* L. and noted the existence of the intermediate forms in *Borrichia arborescens*. Plants with both glabrous and pubescent leaves have been collected throughout most of the range of the species and such intermediates probably exist everywhere both pure forms do. On Jamaica the pubescent form is dominant and the glabrous form is nearly absent. Some small islands appear to have only one form. This may be due to chance introduction of just the one form, but environmental factors favoring one form may exist. The genetics of the conditions have not yet been studied. One plant grown from seed was observed to cycle between glabrate leaves produced in late winter and spring and pubescent leaves produced in the summer and fall. These observations



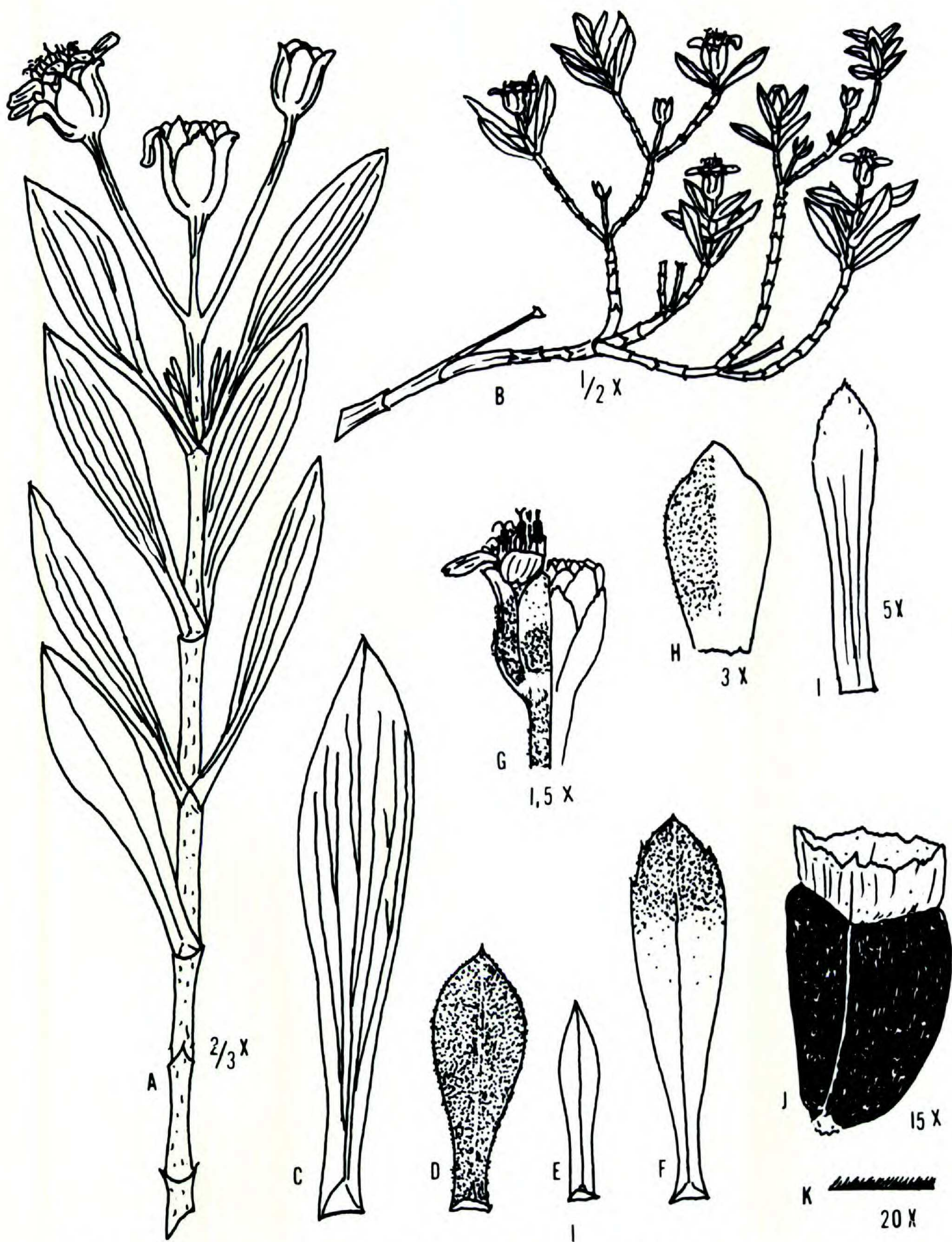


FIGURE 3. *Borrichia arborescens* (L.) DC.—A. Terminal portion of a young shoot.—B. Branch from an older procumbent plant.—C–F. Variation in leaf morphology (all the same scale).—C. Glabrous leaf of the *glabrata*-form.—D. Pubescent leaf of the *argentea*-form.—E. Glabrous leaf from an upper branch (pubescent leaves look similar).—F. Juvenile leaf of a plant that later produced pubescent leaves.—G. Head illustrated in flowering condition on the left side and fruiting condition on the right side.—H. Phyllary (one side illustrates location of pubescence when present).—I. Receptacle chaff.—J. Fruit of peripheral floret (central floret fruit similar to Fig. 2H).—K. Leaf surface diagram illustrating nature of pubescence when present on leaves.



were made while the plant was in a greenhouse in Canada, so conditions may be too different from the wild habitat for the observations to be of great significance. The observations do indicate that the nature of the indument can be changed by modification of the environment. Figure 3 illustrates the morphological characteristics of *B. arborescens*.

BELIZE Glover's Reef, Long Cay, *Fosberg & Sachet* 53804 (GH, MO). Ambergris Cay on Barrier Reef, *Stoddart* 445 (UH), 446 (IJ, US). Stamm Creek, *Shipp* 575 (F, GH, MO, NY).

BERMUDA. Gibbit Is., *Collins* 304 (F, GH, NY, US), 397 (GH). Hungry Bay, *Bailey et al. s.n.* (GH). Long Bud Is., *Brown* 707 (GH, US, NY), 709 (GH, NY). Smith's Parish, Flatts Inlet, *Moore* 2851 (F, GH, NY). Warwick, *Manuel* 104 (GH); *Robinson* 170, 171, 172 (all GH).

MEXICO. QUINTANA ROO: Tancah, *Steere* 2529 (US). Holbox Is., *Gaumer s.n.* (US). Cozumel Is., *Gaumer* 89 (NY).

UNITED STATES. FLORIDA: Dade Co., Coral Gables, King's Bay Country Club, *Morton* (BUS). Elliott's Key, Caesar's Rock, *Britton* 370 (F, NY). *Small & Nash s.n.* (NY). Key Largo, Newport, *Eaton* 429 (TEX). *Traverse* 662 (GH, SMU, TEX). Miami, *Small & Wilson* 1894 (NY). Sands Key, *Rodham s.n.* (GH). Monroe Co., Bahia Honda, *Simpson* 365 (F, US). Big Pine Key, *Killip* 41688 (F); *Killip & Swallen* 49303 (US); *Seibert* 1267 (GH, MO). Everglades Natl. Park, *Graighead s.n.* (GH). Grassy Key, *Stern* 1482 (GH, US). Key West, *Lakela* 27823 (GH); *Hitchcock s.n.* (F). Little Torch Key, *D'Arcy* 3046 (FLAS). Lower Matecumbe Key, *O'Neil* 7613 (GH, NY, US); *Weber s.n.* (FLAS). Marquesas Keys, *Lansing* 2157 (F, NY). Ragged Keys, *Small & Carter* 3120 (NY). Torch Key, *Curtiss* 5436 (GH, MO, NY, US).

WEST INDIES. BAHAMAS: Abaco, Sandy Pt., *Proctor* 30548 (IJ). Acklin's Is., *Brace* 4397 (F, NY). Andros Is., Golden Cay, *Dawson* 26895 (US). Andros Town, *Dawson* 26622 (US). Bimini, NIS., *Howard* 10018 (GH, NY, SMU, US). SIS., Port Royal, Rabbit Cay, *Gillis* 11313, 11314 (both IJ). Caicos, Middle Is., *Burch* 4293 (NY). Crooked Is., *Hitchcock s.n.* (MO). Eleuthera Is., the Current, *Lewis* 7197 (MO, NY). Great Exuma, Jewfish Light Chain, Hummingbird Cay, *Nickerson & Kessler* 2743 (GH). Grand Turk, East Bay, *Proctor* 8771 (IJ); *Nash & Taylor* 3886 (F, NY). Inagua, Sandy Pt., *Nash & Taylor* 1390 (NY); *Dunbar* 77 (GH). Mayaguana Is., Abraham Bay, *Wilson* 7525 (F, GH, NY). New Providence Is., Nassau, *Wright* 9, 25 (both F, GH, NY). Salt Key Bank, Anguilla, *Wilson* 8075 (MO, NY), 8107 (F, NY). Watlings Is., *Wilson* 7288 (F, GH, NY). CAYMAN ISLANDS: Grand Cayman, *Armour* 1239 (F); *Brunt* 1687, 1884 (both IJ), 268 (MO, NY); *Proctor* 11989 (GH). Little Cayman, *Kings* 40 (MO, NY). CUBA: Camaquey, Cayo Palo, *Shafer* 2732 (F, NY, US). Cayo Paredon Grande, *Shafer* 2759 (F, NY, US). Havana, Havana, *Curtiss* 750 (F, GH, MO, NY, US). Playa de Marianas, *León* 3713, 5024 (both NY). Isle of Pines, Bibijagua, *Jemmings* 114 (GH, NY, US). Matanzas, *Britton & Shafer* 44 (NY). Oriente, S of Cape Cruz, *León* 16349 (NY). Santiago, *Clemente* 5318 (NY). Pinar Del Río, Mariel, *Palmer & Riley* 729 (US). Santa Clara, Cienfuegos, *Jack* 8304 (US). Gavitán, *Howard* 4962 (GH, NY). Santiago, Baracoa, *Pollard et al.* 197 (F, GH, MO, NY, US). HAITI: Bayeux in Dept. du Nord, *Eleman* 2556 (GH, IJ). Mahautiere, *Eyerdam* 87 (F, GH, US). La Gonave Is., Bouchia Lagone, *Ekman* 8688 (F, NY). Tortue Is., La Valle, *Leonard* 11430 (GH, NY, US). *Holdridge* 1417 (NY, US). JAMAICA: Bluefields Bay, *Harris* 9975 (NY, US). Port Antonio, *Maxon & Killip* 282 (US); *Millspaugh* 985 (F); *Wight* 160 (F, NY). Hanover, Esher Cove, *Proctor* 23470 (IJ). Middlesex Co., Dry Harbour, *Hunnewell* 11173 (GH). St. Ann's Hall, *Fosberg* 42686 (US). St. Mary, Port Maria, *Proctor* 7531 (IJ). Oracabessa, *Proctor* 6648 (IJ, US). St. Thomas, Holland Bay, *Bengry s.n.* (FLAS, IJ, MO). Westmoreland, Homer's Cove, *Proctor* 33070 (IJ). LESSER ANTILLES: Anquilla, Flat Cap Pt., *Proctor* 17628 (IJ). Antiqua, Mamora Bay, *Box* 1302 (US). Barbuda, *Cowan* 1667 (GH, IJ, NY, US). Guadeloupe, Grande Terre, Moule, *Proctor* 19960 (IJ, US). Marie Galante, Anse Piton, *Proctor* 21096 (IJ, US). St. Croix, *Ricksecker* 24 (F, GH, MO, NY, US). Virgin Is., Anegada Is., *D'Arcy* 4806 (US). PUERTO RICO: Arecibo, *Sargent* 771 (US, TEX). Guanica, *Velez* 645 (NY). Salimas de Cabe, *Urban* 535 (GH, US). San Juan, *Underwood & Griggs* 916 (NY, US). Is. Culebra, *Britton & Wheeler* 239 (NY, US). Mona Is., *Britton et al.* 1765 (NY). Vieques Is., *Shafer* 2671 (NY, US). SANTO DOMINGO: Barahona, Beata Is., *Howard* 12422 (GH, US). Trujin, *Abbott* 1681 (US). Ciudad Trujillo, *Allard* 14386 (US). Puerta Plata, LaBoca Cliffs, *Ekman* 14589 (GH, US); *Jiménez* 4358A (US). San Pedro de Macoris, *Rose et al.* 4263 (NY, US). Samana Peninsula, Cape Samana, *Abbott* 1188a (US).



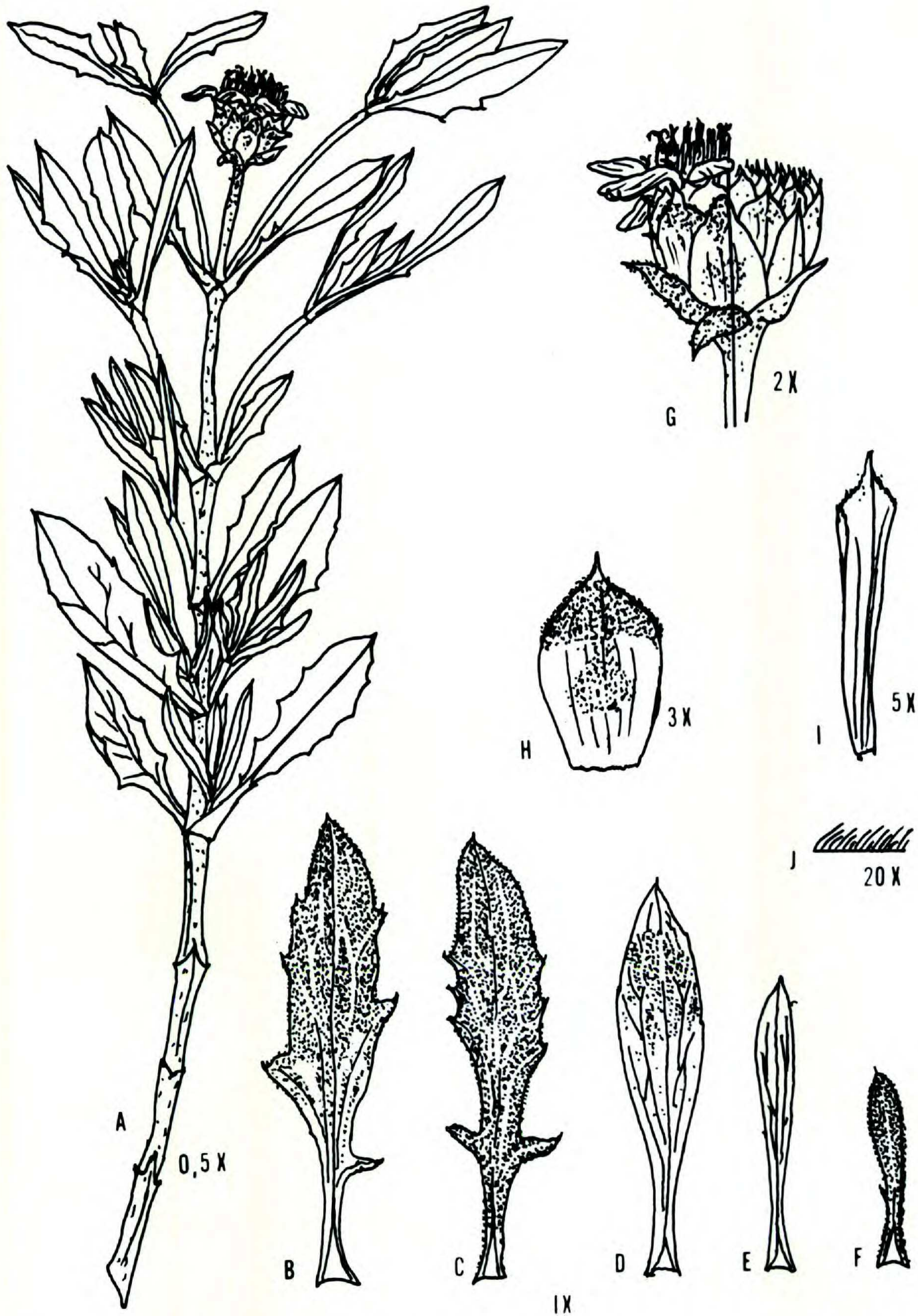


FIGURE 4. *Borrichia*  $\times$  *cubana* Britton & Blake.—A. Branch.—B–F. Range in leaf morphology present on same plant.—B–C. Leaves occurring on primary and secondary stems and branches.—D. Leaf occurring on secondary and higher level branches.—E–F. Leaves occurring on higher level branches.—G. Head illustrated in flowering condition on the left side and fruiting condition on the right side.—H. Phyllary of middle series.—I. Receptacle chaff.—J. Leaf surface diagram illustrating nature of pubescence when present on leaves.



3. **Borrichia** × **cubana** Britton & Blake (pro sp.) stat. nov., Mem. Torrey Bot. Club 16: 116. 1920. TYPE: Cuba, Havana, swamp near Atares Castle, June 1917, *León* 7244 (NY, annotated as the holotype by E. K. Schofield, 1973; NY, annotated as isotype by E. K. Schofield, 1973).

*Fruticose perennials.* Leaves opposite, heteroblastic; primary stem leaves elliptic petiolate, serrate-spinulose along the mid portion of the blade, undulate and coriaceous, more succulent with age; upper branch leaves reduced, sessile, oblanceolate-linear, glabrate to long puberulent. Heads solitary, hemispherical; phyllaries 16–25, in several subequal series, 5–8 mm long, ovate with cuspidate tips, pubescence similar to that of the leaves; chaff slightly folded, oblanceolate cuspidate, but not spinulose, equal to the bracts in length; ray florets pistillate, apparently fertile, yellow, 14–25; disc florets perfect, apparently fertile, yellow, 25–60. Fruit (cypsela) black at maturity, 4-angled, transversely depressed obtrullate to rhombic in cross-section, 3–5 mm long; head brown to black at maturity, hemispheric; phyllaries not thickening with age. Chromosome number:  $n = 14_{II}$ ; Semple (1978) described meiosis in the hybrids.

Detailed experimental and field observations that support the status change of this taxon from that of species to a hybrid between *B. frutescens* and *B. arborescens* were given by Semple & Semple (1978). In the protologue Britton noted that he thought that *B. × cubana* was closely related to *B. frutescens*. The plants are intermediate in nearly all characters between the two parental species. The bracts are large like *B. arborescens* and cuspidate, which is intermediate between the acute *arborescens* condition and the spinulose *frutescens* condition. The hybrids are common in the Florida Keys, the only area where the two parent species are normally sympatric. No hybrids have yet been collected from Bermuda, but they may be present since both parents occur there. There appears to be, or has been, only one population of hybrids in Cuba—namely, the type locality from which several collections were made in 1917 and 1921 (*León* 6870, 7244 and *Ekman* 13292, respectively). The latter is a mixed collection of specimens appearing to be *B. × cubana* and some *B. frutescens* and may represent a sample of a hybrid swarm. It is possible that Ekman sampled the actual parent involved in the cross, but this can not be proven.

Experimental crosses were made between *B. frutescens* and *B. arborescens*. The  $F_1$  progeny were morphologically similar to cuttings of *B. × cubana* collected in Florida. Figure 4 illustrates the intermediate morphological condition of *B. × cubana*.

CUBA. HAVANA: Castillo de Etares, *Ekman* 13292a (GH, NY, MO, US); *León* 6870 (NY).

UNITED STATES. FLORIDA: Dade Co., Adams Key, *Small & Mosier* 5736 (USF). Coral Gables, King's Bay Country Club, *Semple* 1698 (MO, US, WAT). S of Elliott's Key, Caesar's Rock, *Britton* 369 (F, NY). E of Gould, Black Point, *Semple* 1709 (CAN, MO, WAT, US). Miami, MacArthur Causeway, *Semple* 1703 (MO, US). Sands Key, *Semple* 1700-6 (MO, US). Monroe Co., Big Pine Key, *Cornman* 2111 (MO); *Seibert* 1270 (GH, MO); *Semple* 1737 (MO, US, WAT). Craig Key, *Semple* 1755 (MO, US). Key West, *Small & Small* 4911 (GH, US). Long Key, *Long et al.* 2249 (USF). Lower Matecumbe Key, *Semple* 1719 (MO, US). Marquesas Group, Man Key, *Lansing* 2360 (F, NY). Woman Key, *Lansing* 2420 (F). Saddle Bunch Keys, *Semple* 1734 (MO, US).



4. *Borrichia peruviana* DC., Prodr. 5: 489. 1836. TYPE: see following discussion.

*Buphthalmum peruvianum* Lam., Encyl. Méth. 1: 515. 1785.

*B. lineare* Willd., Sp. Pl. 3: 2230. 1803. New name for *B. peruvianum* Lam.

This taxon is known only from the type collection, which is without flowering or fruiting heads. De Candolle (1836) apparently recognized it as a species because some of the leaves have a few spinulose teeth along the mid portion of the blade. These leaves are unlike the other specimens in the other taxa that De Candolle had for examination (as seen on microfiche). The specimen was collected by Dombey in "Peru," far out of the range of the other species, if it actually came from that country. The collection may represent an aberrant *B. frutescens* introduced to "Peru," where the species did not establish itself. A second possibility is that the specimen is from a locale where *B. × cubana* occurred and the specimen is either a hybrid or back-cross. Such a speculative conclusion is based on the presence of similar leaf margin serrations on hybrid plants. If the type of *B. peruviana* is in fact a hybrid between the only true species in the genus, than the name would have priority over *B. × cubana*. Until the original material can be aligned with certainty with one of the taxa treated in this paper, the name *B. peruviana* cannot supplement any of the names used here.

EXCLUDED SPECIES

*Borrichia demissa* DC., Prodr. 5: 489. 1836.

Examination of the type material by Dr. M. Dittrich of Geneva at my request indicates that the pappus of this plant consists of 6–8 subulate scales. For this reason the species is excluded from the genus *Borrichia* as treated here.

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